CARNIVOROUS PLANT NEWSLETTER

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Front Cover: *Pinguicula hirtiflora* from a site on the Amalfi Coast, Italy. Photograph by Barry Meyers-Rice. See article on page 11.

Back Cover: *Pinguicula* 'Pirouette', photo by John Brittnacher. See article on page 14.

Carnivorous Plant Newsletter is dedicated to spreading knowledge and news related to carnivorous plants. Reader contributions are essential for this mission to be successful. Do not hesitate to contact the editors with information about your plants, conservation projects, field trips, or noteworthy events. Contributors should review the "Instructions to Authors" printed in the March issue of each year. Advertisers should contact the editors.Views expressed in this publication are those of the authors, not the editorial staff.

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Noted Horticulturist Peter D'Amato Murders Don Schnell!

Barry Meyers-Rice

In an extraordinary revelation, Peter D'Amato, noted horticulturist, nurseryman, and author, confessed to having murdered *Sarracenia* 'Don Schnell'.

"It was an accident!", D'Amato claimed during an interview. "I was horrified and heartbroken."

Because of a series of unlucky events, this was the only living specimen of this cultivar. With the death of this last individual, *Sarracenia* 'Don Schnell' has been extinguished and remains but as a memory. An outstanding *Sarracenia oreophila* selection, *Sarracenia* 'Don Schnell' is survived by other *S. oreophila* from Sand Mountain, but none have quite the same *je ne sais quois*. Don's wife and family have not been contacted for comment—presumably they are grieving.

The passing of *Sarracenia* 'Don Schnell' is a particularly cruel blow to the Schnell family since it appears that the anthocyanin-free selection of *Sarracenia leucophylla*, also known as *Sarracenia* 'Schnell's Ghost', may also have disappeared into botanical ectoplasm (at least in the United States—reports of it in England continue).

Important lessons may be learned from the extinction of *Sarracenia* 'Don Schnell'. Once a cultivar plant has been selected, published, and registered, it must then be propagated and distributed as broadly as possible! Tissue culture would be the best way to proceed.

Regarding another aspect of cultivars, in the December 1998 issue of Carnivorous Plant Newsletter I mentioned that the ICPS is continuing to work on establishing cultivar names. We have impressed a number of horticulturists into doing this job. If you wish to make your informally named plant into an actual cultivar, contact me immediately with your intentions! While we will do our best to determine the originators of the plants we are registering, we may not be able to determine who made what. Your plant made years ago may inadvertantly be registered without your input!

Lastly, I am excited to announce that the December issue of this year is going to be dedicated to that great British horticulturist, Adrian Slack. If you have something you would like to contribute to the issue, do not delay. (I would in particular like to hear from those who have met Slack or have worked with him.)

Colchicine Treatment on Sterile Hybrid Sundews

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Keywords: cultivation: *Drosera*, hybrids — genetics: colchicine.

Introduction

Sundew hybrids between species with different chromosome numbers are usually sterile. With the treatment of colchicine some of these can be made fertile. The process is fairly simple—I am merely a hobbyist grower but have been able to produce fertile plants without a laboratory. It requires much dedication since it will take several months to nurture and raise treated plants, and longer still to select the most vigorous individuals. Some of you might use the methods I describe to make your own fascinating hybrids fertile. If so, take note that colchicine is toxic and possibly carcinogenic. You must take safety measures when using this chemical, and should certainly study its use before you begin. In any event, I think my results will challenge everyone's imaginations.

What Is Colchicine?

Colchicine is an alkaloid chemical derived from a flowering bulb of the lily family that is known as the autumn crocus (*Colchicum autumnale*). Plant breeders have long used colchicine in the development of new plant cultivars. (It has also been used in the treatment of the disease gout for over 2400 years.) Colchicine can make some plants produce larger flowers or tubers, although the effects are unpredictable. Also, colchicine can be used to restore fertility in sterile hybrids. While many carnivorous plant growers know about colchicine, there is little information about its application on carnivorous plants. Much of this article is based upon what I learned through experimentation.

How Colchicine Works

Colchine acts by disrupting cell plate formation during cellular division, so that as a plant cell divides into two cells it does not split. This produces a single cell with a doubled nucleus having twice the chromosome number. A plant with the chromosome number so increased by some multiple is known as a polyploid. Do not think of this as a corruption of nature. Polyploidy is a common natural occurrence, resulting from accidents in cell division. About half of all flowering plants have had origins in polyploidy (although the vast majority of *Drosera* are normal diploids with no evidence of polyploidy).

Hybrid plants are often sterile because the parent species have different chromosome numbers—as a result the chromosomes from the parents cannot pair compatibly. If such a hybrid has its chromosome number doubled, then the chromosomes are paired with their doubles. The genetic mechanics of the cell can then function more adequately and fertility is restored. The natural creation of such "allopolyploids" is an important process in the creation of new species because allopolyploids are sexually reproducing organisms. A prime example of a cultivated natural allopolyploid is the economically important bread wheat (*Triticum aestivum*), a hexaploid combination of three separate species. At least two sundews, perhaps more, evolved by means of allopolyploidy. In 1955 the botanist C.E. Wood (Wood, 1955) showed that *Drosera anglica* arose from the hybridization of two other species: *D. rotundifolia* (20 chromosomes) + *D. linearis* (20 chromosomes) = *D. angli-*

ca (40 chromosomes), although it was not proven that *D. linearis* was one of the parent species. I show a chromosome set diagram for this cross in Figure 1A. More recently (Nakamura & Ueda, 1991), scientists have found that the previously named *D. spatulata* 'Kansai' from Japan differed in chromosome number from the more typical form (60 chromosomes vs. 40 chromosomes, respectively) and is now called *D. tokaiensis*—it is probably another allopolyploid; *D. rotundifolia* (20 chromosomes) + *D. spatulata* (40 chromosomes)= *D. tokaiensis* (60 chromosomes).

What Can Be Done With Colchicine?

I have always been an avid tinker with my plants. Often I attempt cross-pollination experiments. Sometimes I have a clear picture in my mind of what kind of interesting new hybrid I want to achieve. But most times I just want to see what will happen. I have had several successes but far more failures. All this work tells me something, even the failures. Though I may not make something worth keeping, I do learn which plants are most closely related. In general, a sundew hybrid is either not formed at all after cross-pollinating two species with different chromosome counts, or the resultant hybrid is sterile and totally unable to produce seed. Fernando Rivadavia (another tinker) and I have found just a few exceptions to this general rule. We were surprised when the cross between *D. burmannii* from Australia and *D. sessilifolia* from Brazil proved to be fertile. (We are constantly debating about whether they should be considered separate species.) Amongst South African sundews, *D. dielsiana, D. nidiformis*, and *D. venusta* can all be crossed and produce fertile hybrids. Most *Drosera* hybrids involving species with the same chromosome count are perfectly fertile.

How Colchicine Is Applied

Colchicine is applied in various ways, and may be purchased as a powder (from chemical catalogs) or a premixed, ready to use paste (from a plant breeding supply company). When using the powder, the solution strength is not critical—I just mix colchine with enough water to dissolve it. In strawberry and other vegetable breeding a 1% solution is usually used. In every treatment method, the cells dividing in the meristematic growth point must be affected. If improperly treated, only a portion may be affected and the polyploidy will not continue throughout the plant. Seeds or entire seedlings can be soaked or it can be applied only to a plant's growth point. With orchids, colchicine is used in sterile tissue culture. For sundews it is best to treat leaf cuttings. I prepare cuttings on live sphagnum moss. I have found it is best to wait until tiny plantlets are sprouting. Soak the leaf cuttings (with tiny plantlets) in colchicine for 24 hours, using a sealed dark container (colchicine degrades in light). I next rinse off the cuttings and replace then on the sphagnum until they have grown to transplantable size.

Treated plants must be watched carefully to look for colchicine effects. When I treated the *D.* × *nagamotoi* (as described below), I obtained three plants. Two grew vigorously and looked healthy, while the third grew much more slowly and looked diseased. When the plants flowered I found that the weak plant was the only one that made seed, even though it did not make much pollen. Therefore, it was the only plant of the three made fertile by colchicine—the others were unmodified by the treatment. The seed from this plant produced seedlings with regained vigor. (Perhaps the newly polyploid nucleus is unstable and is stabilized by the act of reproduction.)

It is interesting that the first generation of allopolyploid *D.* × *nagamotoi* was so weak and slow-growing. This may be why more sterile sundew hybrids in nature do not spontaneously achieve fertility through amphiploidy to become new species as

D. anglica has done—perhaps the amphiploids are too weak to adequately reproduce themselves in nature. Perhaps only those natural hybrids which are not adversely affected by autopolyploidy have become new species, such as *D. anglica* and *D. tokaiensis*. Clearly; more research is required. I think this weak generation is also why others may have failed in using colchicine. A grower will automatically select the more vigorously growing plants and unknowingly dispose of the weaker plants which are the ones affected by the colchicine.

What Has Been Done So Far

I do not like sterile plants. (I discard all the sterile hybrids I make after my study of them is complete.) One exception to this is the natural hybrid called *D.* × *obovata*, a cross between *D. rotundifolia* and *D. anglica*. I have a specimen of this very attractive sundew as a living souvenir of a most wonderful camping and hiking adventure I had in July 1997 in northern California. I hoped to make this sterile plant into a fertile one so I could more easily spread it around to others as seed—it would be a thrill to see such a unique new plant offered in the ICPS seedbank. Unfortunately, all my attempts to produce a polyploid *D.* × *obovata* have resulted in weak plants (see Figure 1B). It looks like *D.* × *obovata* is an evolutionary dead end.

I have also treated a hybrid I made by crossing *Drosera anglica* (40 chromosomes) from Hawaii with a tetraploid *D. spatulata* (40 chromosomes) which I collected in Australia. Although I initially wanted to give this plant a new name, the parent species had previously been hybridized and officially named *D.* × *nagamotoi*, so that valid name must be used instead. I have been successful in changing *D.* × *nagamotoi* into a fertile octoploid with 80 chromosomes (see Figures 1C, 2). The octoploid has the highest chromosome count known for a sundew. Only one other species, *D. aliciae*, is reported to have this number but this high count is disputed (Bennett & Cheek, 1990). The flower of the allopolyploid *D.* × *nagamotoi* is white or pink. This sundew is not really better than anything that we already have, it is just something new. I have also made a fertile hexaploid *D.* × *nagamotoi* with 60 chromosomes (see the details given later in this paper). The most important feature of these plants is that they are the first manmade fertile "species." (Remember that it is much like the natural allopolyploid species *D. anglica*.) Even though these artificially enhanced crosses are interesting, they must still prove their benefit to horticulture.

In Table 1 I list most of the *Drosera* crosses I have attempted. It may be helpful for those who are studying the relationships of different species within the genus. Note, for example, that all the sterile hybrids of species with equal chromosome numbers listed involved *D. brevifolia*. Crosses I am making at the time of this writing are not included. For example, I am awaiting flowering of treated *D.* × *beleziana*. One of these is more densely tentacled, possibly a result of polyploidy.

Nomenclature and Taxonomy

This "new species" business is bound to bring about confusion and argument among those concerned with nomenclature. In my own notes I find it most convenient to simply list my first success as *D. nagamotoi* without the × symbol. Until a taxonomist officially publishes the name, the rule is that we must call it *D. anglica* × *spatulata*—fertile octoploid, or a little shorter *D.* × *nagamotoi*—octoploid. An even greater concern to taxonomists is the possibility that some unscrupulous breeder may try to pass off his own creation as a newly discovered species!

The latest trick I learned involves not doubling, but instead reducing chromosome numbers. While thinking about what would happen if a polyploid is crossed with a plant of a different ploidy, I developed a theory that I later learned has already been applied in breeding strawberries. The theory is basically that even-ploidy numbers in balanced allopolyploids—tetraploids, hexaploids, and octoploids—are fertile. Odd-ploidy numbers such as triploids are always sterile. I have found that this can be true regardless if they are made by doubling the chromosome number or by reduction. I have experimented along these lines with different polyploids of *D.* × *nagamotoi.* By crossing my octoploid *D.* × *nagamotoi* (80 chromosomes) with the tetraploid *D. anglica* (40 chromosomes) I created a hexaploid *D.* × *nagamotoi* (60 chromosomes), which is (by chromosome count) one third *D. spatulata* and two thirds *D. anglica*. This new hexaploid is fertile (see Figure 1D). This polyploid might also be made by crossing a diploid *D. spatulata* (20 chromosomes) from New Zealand with *D. anglica* (40 chromosomes) and then doubling the chromosomes with colchicine. The theory is not perfect—while my hexaploid *D.* × *nagamotoi* is fertile, it had totally defective pollen. In order to get seed I must use good pollen from another plant. But maybe I can use this plant for making something else.

I wonder what would happen if I crossed my new hexaploid *D.* × *obovata* (60 chromosomes) with *D. linearis* (20 chromosomes), but did not apply colchicine? The result would have 30 chromosomes from *D.* × *obovata* and 10 from *D. linearis* — that is, a tetraploid having a total of 40 chromosomes. This is much the same as *D. anglica* which has 40 chromosomes, half of which originate from *D. rotundifolia*

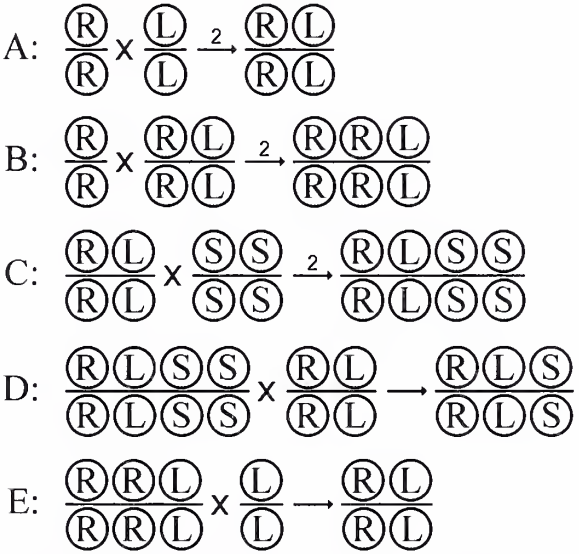

Figure 1: A) A chromosome set diagram showing how *D. rotundifolia* hybridized with *Drosera linearis*, followed by chromosome doubling via natural means (indicated by × 2) results in *Drosera anglica.* Each circled letter represents 10 chromosomes. B) Crossing *Drosera anglica* (see Figure 1A) with *D. rotundifolia*, followed by chromosome doubling via colchicine, resulted in a hexaploid *Drosera* × *obovata.* C) Crossing *Drosera anglica* (see Figure 1A) with a tetraploid *Drosera spatulata*, followed by colchicine doubling, resulted in a octoploid *D.* × *nagamotoi.* D) Crossing the octoploid *D.* × *nagamotoi* (see Figure 1C) with *Drosera anglica* resulted in a hexaploid *D.* × *nagamotoi.* E) Crossing the hexaploid *D.* × *obovata* (see Figure 1B) with *Drosera linearis* leads back to *Drosera anglica.*

and half from *D. linearis*. But would it be fertile? It seems as if it would be, if *D. anglica* was in fact half *D. rotundifolia* and half *D. linearis* (see Figure 1E).

What May Come in the Future

By using the diagrammatic theory, some very interesting new creations can be planned. I am now seeing new possibilities through crossings and selections of different polyploids. The colchicine-related deformities previously mentioned can be completely removed by crossing a treated plant with a normal untreated plant. Much more can be done with my octoploid *D.* × *nagamotoi*,and it is fun just to work out the permutations. Next I plan to cross different polyploids to see just how similar they must be in order to make fertile crosses. For instance, the hexaploids *D.* × *obovata* and *D.* × *nagamotoi* are both two thirds *D. anglica* and so differ by only one third (although, it should be noted that *D. anglica* is in turn one half *D. rotundifolia*, which is also the other parent of *D. obovata* but not of *D. nagamotoi*, so the first is in effect a back-cross, while the second is not.); will these make a fertile cross? Or perhaps plants differing by only one quarter can make a fertile cross? If this is possible then we can more easily mix and match traits of different species to produce novel cultivars, or recreate already existing species. I have crossed the hexaploid *D.* × *nagamotoi* with *D. rotundifolia*, reducing the chromosome number again to 40. This cross may be compatible with *D. anglica*. If this proves factual, then the pink flower from *D. spatulata* can be imported to *D. anglica*! In another direction, *D. tokaiensis* might be re-engineered by crossing the octoploid *D.* × *nagamotoi* with a tetraploid *D. spatulata*. The result would be a hexaploid that may be compatible with *D. tokaiensis*.

There is much more experimentation that needs to be completed, and this is only the beginning. I anticipate more successes. I hope that colchicine treatment

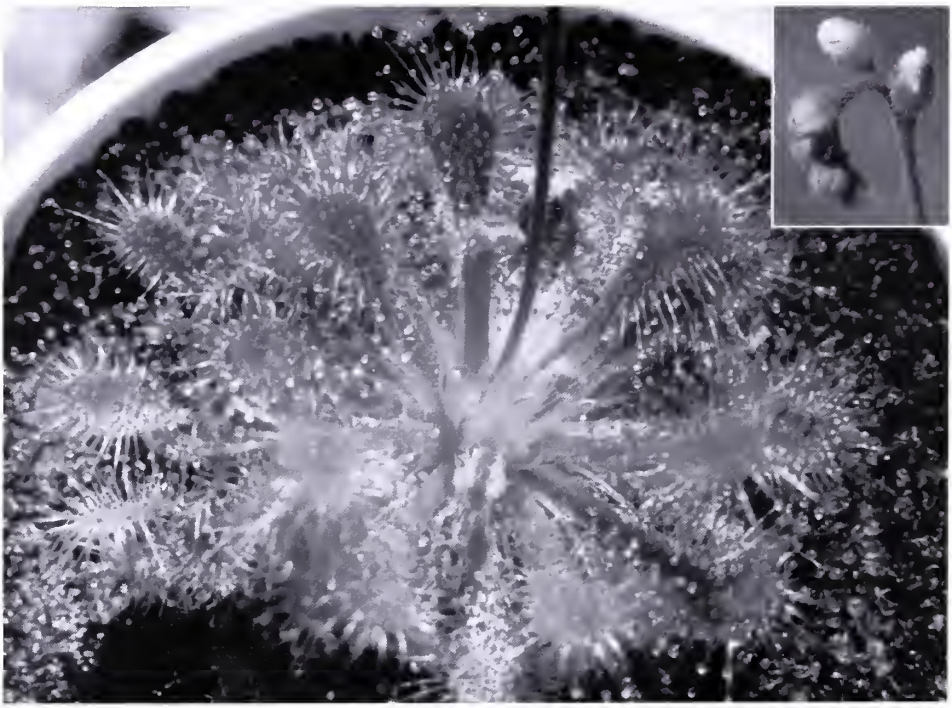

Figure 2: The fertile octoploid form of *D.* × *nagamotoi* created by the author. Photo by Edward Read.

Table 1: *Drosera* hybrids.

D. anglica × *indica*	B
D. anglica × *spatulata*	E
D. anglica × (× *nagamotoi*)	F
D. brevifolia × *aliciae*	D
D. brevifolia × *glanduligera*	B
D. brevifolia × *rotundifolia*	E
D. brevifolia × *spatulata*	E
D. brevifolia × *burmannii*	A
D. burmannii × *glanduligera*	A
D. burmannii × *sessilifolia*	G
D. capensis × *collinsae*	C
D. capensis × *dielsiana*	A
D. capensis × *spatulata*	B[1]
D. dielsiana × *nidiformis*	G
D. (*dielsiana* × *nidiformis*) × sp. Rhodesia	G
D. (*dielsiana* × *nidiformis*) × *spatulata*	D
D. esmeraldae × *anglica*	E
D. indica × *adelae*	A
D. madagascariensis × *spatulata*	A
D. montana × *brevifolia*	C
D. rotundifolia × *anglica*	E
D. rotundifolia × *brevifolia*	E
D. spatulata × *montana*	B
D. anglica—California × *anglica*—Hawaii	G
D. brevifolia—Louisiana × *brevifolia*—North Carolina	F
D. spatulata—typical Australian × *spatulata*—Gympie type	G

[1]Reported as F by others

The results of each cross are coded as follows. A—no seed or enlarged capsule produced; B—nonviable seed produced; C—seed viable but seedlings died; D—weak, sterile plants result; E—strong, sterile hybrids made; F—hybrids fertile, but with defective pollen; G—healthy, fertile hybrids.

can be as important a tool in the breeding of our interesting carnivorous plants as it has for flowers and vegetables. At the time of writing, all my creations have been small sundews. Larger plants would be more popular. I have just begun working on crossing my tropical *D. anglica* with the Florida *D. filiformis*. I may get some large plants having no dormancy requirement. This, when treated with colchicine, will produce a hexaploid which might possibly make a fertile cross with *D.* × *nagamotoi*. This in turn would lead to a high degree of variability for much more future selection. Watch for the diabolical manmade sundew species!

Before you begin to design your own new species, here is a helpful hint. I learned that it is best to start working with easily grown and freely flowering hybrids. The "tropical" *D.* × *obovata* I finally made was by using the more easily grown Hawaiian form of *D. anglica* crossed with *D. rotundifolia*. The natural *D.* × *obovata* I had first treated was too weak to sufficiently produce a hibernaculum, as it must do before flowering.

Much selecting must be done to sort out the strongest seedlings. Expect defor-

mities; my *D.* × *nagamotoi* has ragged petals. Some hybrids will be too malformed to be of value. All hybrids may not be so adversely affected by colchicine. *D.* × *beleziana* does not seem to exhibit much deformity, while *D.* × *obovata* is extremely malformed and not worth reproducing.

I wish anyone else thinking of undertaking a treatment project good luck. It is fun just to think of the possibilities. More people will likely want to simply cross-breed the different polyploids rather than use a dangerous chemical. I do hope to see others produce some outstanding new cultivars through the use of colchicine.

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Colchicine Hazards

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Keywords: Genetics: colchicine.

(While Ivan Snyder's experiments are exciting, we wish to ensure that the biohazards associated with colchicine are clearly understood by readers of Carnivorous Plant Newsletter. We invited Sean Barry, from the University of California, to comment on the compound—BAMR)

Colchicine is by far the most dangerous chemical that home-based cell culturists might encounter in their experiments. It is part of a disparate group of chemicals that are capable of altering genetic material, in this case by disrupting the mitotic spindle that aligns and "tracks" the chromosomes during cell division. Cell division is thus arrested, and the result is polyploidy, or multiple sets of chromosomes (>2) within a single cell. This is potentially desirable in plant genetic engineering, but extremely hazardous if it affects certain tissues in the user, particularly germ cells (sperm and ova) and the developing embryo. For this reason, colchicine is classed as a teratogen (a substance that causes birth defects) and may also be a potential carcinogen. Colchicine is also very toxic. A single oral dose of as little as 3.0 milligrams (that is 0.003 grams, or 0.0001 ounce) has caused death, and the rat LD50 (i.e. the dosage that is lethal to about 50% of an experimental group) is as little as 0.125 milligrams per kilogram of body weight (and is presumably comparably toxic to humans). The material is equally toxic when ingested, inhaled as powder, or absorbed through the skin. Potential users of colchicine should first be trained in proper storage, handling and personal protection measures, and they should observe state and local disposal regulations.

References: Mallinckrodt-Baker and Abbott Labs Material Safety Data Sheets for colchicine reagent and pharmaceutical preparations.

Two New *Pinguicula hirtiflora* Ten. (Lentibulariaceae) Sites in Italy

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Keywords: field studies: Italy, *Pinguicula hirtiflora*.

Introduction

Pinguicula hirtiflora Ten. is a rare species of insect eating plant found mainly in the area stretching between Albania and Asia Minor. It favours rock faces dripping with water, and grows at altitudes between 300 and 1300 metres above sea level.

This species has only rarely been sighted in Italy, and has been found growing in isolated sites which are difficult to reach, such as in the Calabria region near Rossano Calabro. To date, sightings have been even rarer in the Campania region and the few examples found on the mountains above Castellammare di Stabia and on the Amalfi coast were reported many years ago (see Front Cover).

During botanical excursions in April 1998 to study its current distribution, we discovered two previously unknown colonies in the Campania region of Italy.

Observations on the First Site

On the 9th of April 1998, we discovered the first new site of *Pinguicula hirtiflora* Ten. in the Avvocatella area, outside the town of Cava dei Tirreni, 202 metres above sea level. The plants were growing in a 10-11 m^2 area on top of an anthracite grey-coloured rock (most likely volcanic in origin) dripping with water. The rock's consistency was compacted and not friable, and presented a natural dome-shaped conformation protruding above the road.

The population was very large and consisted of approximately 400 plants. They were fairly evenly distributed in an area ranging from one to three meters above the base of the rock face, where they were protected from direct sunlight.

Observations on the Second Site

On the 14th of April 1998 we came across two more populations of *Pinguicula hirtiflora* Ten. in the Badia di Cava area, outside the town of Cava dei Tirreni, 303 m above sea level. The site was a large rocky ridge which was dripping with water in a few parts, and which was not standing in direct sunlight. The plants were growing on top of wet rock whose consistency was compacted and not friable, portions of which had a slightly concave conformation. The two populations were separated by a few meters, and numbered less than 100 individuals in total.

The plants were fairly evenly distributed over the face of the rock wall, at 40-90 centimetres above the ground.

Conclusions

We took samples of *Pingicula hirtiflora* Ten. to try to acclimatise them to a section of the Botanical Gardens of Naples which offers conditions similar to their natural habitat. Constant observation of these samples has shown that they have adapted very well indeed—the results regarding their introduction and present cultivation methods employed could be deemed excellent. There is no doubt that this success is also due to the particularly favourable microclimate in which they have been grown.

The authors intend to perform chromosomic and floristic studies as well as examinations of the distribution of *Pinguicula hirtiflora* Ten. for the Garden's herbarium, which is part of the Department of Vegetable Biology of the University of Naples. As part of a joint collaboration with foreign experts, surveys will be carried out in Campania and other known sites where this rare and most interesting insect-eating plant grows, with a view to producing a detailed up-to-date map of the existing populations.

New Cultivars

Keywords: cultivar: *Sarracenia* 'Imhotep', *Dionaea* 'Dentate Traps', *Dionaea* Dentate Traps Group, *Dionaea* 'Sawtooth', *Pinguicula* 'Pirouette', *Utricularia* 'Yog-Sothoth', *Utricularia* 'Mrs. Marsh', *Utricularia* 'Lavinia Whateley', *Utricularia* 'Cthulhu'.

Sarracenia 'Imhotep'

Davis is in the central valley of California, and experiences long, hot, dry summers. Each year in October, the Botanical Conservatory at the University of California in Davis (UCD) participates in an enormous plant sale. On the day of the annual sale, the *Sarracenia* are always a little toasted—shoppers eschew grand *S. flava* specimens, just because the pitcher tops are burnt and brown. However, one hybrid plant still looks fresh even this late in the season. We call it *Sarracenia* 'Imhotep'. Of uncertain ancestry, *Sarracenia* 'Imhotep' has clear influences from *S. minor* (i.e. a bulging but cylindrical pitcher, a round lid, and fenestrations on the back of the upper third of the pitcher tube). An overall coppery colour, manifested late in the season, is probably also due to *S. minor* ancestry (Figure 1). The other parent is uncertain, but may be either *S. alata* or *S. rubra*. I suspect it is probably *S. alata*—the large size, enhanced vertical pitcher veining, and pale greenish petals are all consistent with this. This plant must be propagated vegetatively to maintain this complex mix of attributes. It is probable that this plant arrived at UCD via trades with California State University at Fullerton.

I will be the first to admit that more attractive *Sarracenia* hybrids have been developed, yet this plant has excellent features. Its ability to persist well into a hot, arid summer is noteworthy. It is a marvelous plant for casual growers who wish to have perhaps just one pitcher plant in their garden, and would like it to look good all season long.

I nominated the name 'Imhotep' on 2 October 1999, and submitted it for regis-

Figure 1: *Sarracenia* 'Imhotep', photo by Barry Meyers-Rice

tration on 22 October 1999. The name 'Imhotep' commemorates the fictional character of the same name played by Boris Karloff in the classic horror film, The Mummy. Despite having to weather thousands of years of arid and hot climate, this ancient Egyptian priest was still handsome and tanned, albeit a bit veiny.

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Figure 2: *Dionaea* 'Dentate Traps', photo by Barry Meyers-Rice

Figure 3: *Dionaea* 'Sawtooth', photo by Barry Meyers-Rice

Dionaea 'Dentate Traps'

A wild collected *Dionaea muscipula* plant was selected because its marginal spines were noticeably mutated. Instead of being long and filiform (as is usual), the spines of *Dionaea* 'Dentate Traps' are short and triangular. This feature is not always apparent on small traps, or those produced early in the season, but the traps on mature plants in full growth are unmistakably dentate (Figure 2).

This plant has been widely distributed in the past under the name "dentata." This name is invalid according to ICNCP rules (Art. 17.9.). Ron Determan (Atlanta Botanical Gardens) has informed me that the plant often distributed under the name "dente" is the same as the "dentata" plant, so the correct name *Dionaea* 'Dentate Traps' must be used for that plant as well. The cultivar name refers to the form of the marginal spines on the traps; I have both nominated and submitted this name for registration on 20 October 1999. The originator of the plant is probably Leo Song, Jr., who started growing the plant prior to 1990. The preferred method of propagating it is by vegetative means, so the character of the teeth is best maintained.

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Dionaea Dentate Traps Group

Most *Dionaea muscipula* plants have traps fringed with marginal spines (often called tentacles). These spines may rarely be as long as the width of a single trap lobe, but they are more typically shorter—perhaps 1/3 the width of a single trap lobe. The spines are filiform, and the thickness of a single spine is much smaller than the distance between spines. Recently, *Dionaea* cultivars have been registered which have the unifying characteristic of modified spines. In particular, the cultivars *Dionaea* 'Dentate Traps' (described above), *Dionaea* 'Sawtooth' (described below), and *Dionaea* 'Red Piranha' (Read, 1999) all have spines which have been reduced into small teeth. These teeth are much shorter than 1/3 the trap lobe width, and are triangular (and not filiform) in outline (in the cultivars *Dionaea* 'Sawtooth' and *Dionaea* 'Red Piranha' the teeth are further denticulate). The *Dionaea* Dentate Traps Group includes those registered cultivars with this spine modification. This cultivar group does not contain cultivars that have traps mutated so that multiple spines are fused together, unless the individual spines can be identified as being shortened and triangular. The cultivar group name refers to the form of the marginal spines on the traps; I both nominated and submitted this name for registration on 20 October 1999.

Reference:
Read, E. 1999, New Cultivar *Dionaea* 'Red Piranha', Carniv. Pl. Newslett. 28:99.

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Dionaea 'Sawtooth'

This *Dionaea muscipula* is of uncertain origin, but has been distributed without an established name. As such, the commonly used name *Dionaea* 'Sawtooth' is being registered.

Dionaea 'Sawtooth' is a remarkable plant in the *Dionaea* Dentate Traps Group (described above). Its marginal trap spines are reduced to small triangular teeth, as

in *Dionaea* 'Dentate Traps' (see description on page 16). Unlike that latter cultivar, however, the teeth of *Dionaea* 'Sawtooth' are frequently minutely divided into two or more tiny teethlets, so the trap has an almost fringed appearance (Figure 3). Late in the season, the interior of the traps may be deeply red, although this is not visible in young traps (cf. The Savage Garden, Peter D'Amato, 1998, 1st Edition, p67.). The cultivar name refers to the form of the marginal spines on the traps; I both nominated and submitted this name for registration on 20 October 1999. The preferred method of propagating this plant is by vegetative means, so the character of the teeth is best maintained.

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Pinguicula 'Pirouette'

This *Pinguicula agnata* × (*moranensis* × *ehlersiae*) hybrid is another product of Leo Song's active hybridization program at California State University at Fullerton. Resulting from a cross made 14 October 1986, this plant has proven itself to be forgiving of cultivation errors and resilient to adverse growing conditions. Its flowers are attractive and clear pink, similar in general plan to *P. moranensis* but with more rounded petals, akin to those of *P. agnata*. Mature plants are about 7 cm. in diameter and may produce a few blooms each year. It is the leaves that are the most striking feature of this plant—it has inherited the opalescent pinky-white foliage of *P. ehlersiae*. In some growing conditions *Pinguicula* 'Pirouette' becomes so suffused with rich-pink or even red (see Back Cover) it looks remarkably like a chlorophyll-free saprophyte one might encounter deep in pine woods! Under moderate light, the leaves are very pale pink with a touch of light green (Figure 4).

The leaves this plant produces during the dormant season are smaller and more succulent. Leaf cuttings are best taken with these leaves just before or as the summer leaves begin to emerge. The leaf cuttings root easily. This plant should not be propagated by seed if you wish to maintain the cultivar name attached to it.

Its good looks and easy cultivation make *Pinguicula* 'Pirouette' an excellent beginner's plant. If you want to try a carnivore on your windowsill, this might be the one to start with! Plants are distributed each year at the UCD Botanical Conservatory plant sale, and are also available at California Carnivores.

The name *Pinguicula* 'Pirouette' was coined because the neatly overlapping, layered leaves give the impression of a swirling pleated skirt. The intense pink color adds to the skirt impression; the emerging leaves add arms to suggest a ballerina doing a fast turn. This plant name was nominated (by John Brittnacher) on 2 October 1999, and sent for registration (by Barry Meyers-Rice) on 20 October 1999.

—John Brittnacher, Barry Meyers-Rice, Leo Song • 1326 Notre Dame Drive • Davis, California 95616 • USA • jgbrittnacher@ucdavis.edu.

Utricularia calycifida 'Yog-Sothoth'

In order to be appreciated, many *Utricularia* species must be observed on a near-microscopic scale. The flowers are often small, and the leaves are usually tiny. *Utricularia calycifida* is different. Not only are its flowers moderately large, but compared to most species in cultivation its leaves are gigantic (forgive me for using such a dramatic term for leaves but 5 cm or so long). The leaves of some *U. calycifida* clones are actually showy! *Utricularia calycifida* has many clones in cultivation with a diversity of flower and leaf forms, so there is great potential for intraspecific hybridization.

Figure 4: *Pinguicula* 'Pirouette', photo by Barry Meyers-Rice

Figure 5: *Utricularia* 'Lavinia Whateley', photo by Barry Meyers-Rice

Figure 6: *Utricularia* 'Cthulhu', photo by Barry Meyers-Rice

I have discussed *U. calycifida* before, in pages 9-13 of the 21:1-2 issue of Carnivorous Plant Newsletter (1992). In that article I used the tentative, descriptive phrase "purple veins" to describe one commonly cultivated form. This form has petiolate leaves with a oval lamina that are veined throughout with deep purple pigmentation (see Carniv. Pl. Newslett. 21:1-2, p. 10, Figure 1:1). The flowers are large, and the apron-like lower corolla lobe hangs down and nearly completely hides the spur. The corolla is pink, but with a yellow patch (edged in white) on the proximal palate bulge (see Carniv. Pl. Newslett. 21:1-2, p. 12, Figure 3). This plant is being established as the cultivar *Utricularia calycifida* 'Yog-Sothoth'.

While *Utricularia* 'Yog-Sothoth' can produce self-fertilized viable seed, to preserve the cultivar name care must be taken to ensure the progeny meet the floral and leaf characteristics described in this article. As such, I recommend vegetative propagation which, like in so many *Utricularia*, is trivially simple.

The cultivar name was nominated and submitted for registration by me on 22 October 1999. The cultivar epithet notes the potent and enigmatic entity mentioned in various stories by the 1930s author H.P. Lovecraft. The original Yog-Sothoth and the cultivar share features such as peculiar venation, countless sucking mouths, and an insatiable appetite.

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Utricularia calycifida 'Mrs. Marsh'

In an article on *Utricularia calycifida* (Carniv. Pl. Newslett. 21:1-2, p9-13, 1992) I discussed a clone that I referred to as "spotted flower." This unestablished epithet is being abandoned, and the cultivar name *Utricularia calycifida* 'Mrs. Marsh' is being established in its place.

I described the flower of *Utricularia* 'Mrs. Marsh' in detail in that article, and for convenience I am using the "Figure 2" that appeared on page 12 as a photographic standard. In summary, *Utricularia* 'Mrs. Marsh' can be recognized by its small white to pale-lilac flower. The corolla lips are decorated with small purplish-brown spots which are sometimes stretched into streaks. The orange-yellow palate splotch is edged in brown. The overall effect is remarkably similar to the patterning on some frogs or tiger cowrie sea shells (*Cypraea tigris*). The leaves are strap shaped, and are purplish only when growing rapidly.

This plant self fertilizes readily and produces seed which breed true. Some seedlings are vigorous than others, so this plant is best reproduced vegetatively.

Utricularia calycifida 'Mrs. Marsh' was first given to me (without a cultivar name) by the noted Arizonan carnivorous plant grower, Paul McMillan. The cultivar name was nominated and submitted for registration by me on 22 October 1999. The name commemorates the second wife of Captain Obed Marsh, from H.P. Lovecraft's tale, *The Shadow Over Innsmouth*. This mysterious figure was known for her froglike appearance and strange affinity to water.

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Utricularia calycifida 'Lavinia Whateley'

As I mentioned in a previous note (Carniv. Pl. Newslett. 22:3, p.56, 1993), a white-flowered variant of *Utricularia calycifida* exists and has been grown with the name *Utricularia calycifida* "White Flower". This epithet has not been registered, and since it is overly ambiguous, I propose instead the name *Utricularia calycifida* 'Lavinia Whateley'. This cultivar's flower is similar in form to that of *Utricularia calycifida* 'Yog-Sothoth' (see page 17), except instead of predominantly pink, the flower is white (Figure 5). The yellow palate splotch is present. The leaf veins are not heavily tinted purple. I recommend vegetative propagation which is easy with this plant, and will ensure vigorous progeny with no loss of cultivar characteristics.

The cultivar name was nominated and submitted for registration by me on 22 October 1999. The cultivar epithet honors the peculiarly pale, white-haired woman who appeared in H.P. Lovecraft's short novel, *The Dunwich Horror*.

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Utricularia calycifida 'Cthulhu'

As I mentioned in a previous note (Carniv. Pl. Newslett. 22:3, p.56, 1993), an interesting, mauve colored form of *U. calycifida* is particularly noteworthy. This plant bears rounded, purple-veined leaves as does *Utricularia calycifida* 'Yog-Sothoth' (described on page 17). The flowers are also large as in that cultivar, but differ in the details (see Figure 6). First, the palate bulge is more rounded, pronounced and distinct from the rest of the lower corolla lip. Second—and most obviously—the yellow palate splotch is larger and surrounded by numerous anastomosing pale veins. The mauve-pink that contrasts with the pale veins is more saturated than the pink that colors the rest of the flower. This plant should be propagated

by vegetative means in order to maintain its delightful characters faithfully.

The epithet 'Mauve Flower' had not been established, so I proposed instead the name *Utricularia calycifida* 'Cthulhu'. The cultivar name was nominated and submitted for publication by me on 22 October 1999. The cultivar epithet is chosen in commemoration of the fictional creature described by H.P. Lovecraft. Like its namesake cultivar, Cthulhu (pronounced "k-THOO-loo") was a denizen of a semi-aquatic land, and was endowed with countless stolon-like tentacles.

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Literature Reviews

Brewer, J.S. 1999, Effects of Fire, Competition and Soil Disturbances on Regeneration of a Carnivorous Plant (*Drosera capillaris*), American Midland Naturalist, 141: 28-42.

Brewer, J.S. 1999, Effects of Competition, Litter, and Disturbance on an Annual Carnivorous Plant (*Utricularia juncea*), Plant Ecology, 140: 159-165.

While the erosion of crayfish mounds tends to increase the mortality of juvenile plants of *D. capillaris*, the same phenomenon apparently favours establishment of *U. juncea*. The other details in the two papers are quite predictable. Interested readers should read the original publications. (JS)

Brewer, J.S. 1999, Short-Term Effects of Fire and Competition and Plasticity of the Yellow Pitcher Plant, *Sarracenia alata* (Sarraceniaceae), Am.J.Bot. 86: 1264- 1271.

Another article by the meanwhile well-known author. Mature plants can tolerate competition (as a result of missing fires) on a short-term basis. "Yellow" is the worst possible vernacular name for the studied pitcher plant, because it immediately evokes associations with the much more common *Sarracenia flava*. (JS)

Hoshi, Y. & Kondo, K. 1998, Chromosome Differentiation in *Drosera*, Subgenus *Rorella*, Section *Rossolis,* Cytologia, 63: 199-211.

Hoshi, Y. & Kondo, K. 1998, A Chromosome Phylogeny of the Droseraceae by Using CMA-DAPI Fluorescent Banding, Cytologia 63: 329-339.

Both papers present interesting new data (many new chromosome counts and state-of-the-art cytological characteristics) elucidating the phylogeny and speciation processes in Droseraceae. The remarkable diffused centrosomal organization of the chromosomes of many *Drosera* species (especially from the southern hemisphere) may be responsible for accelerated/facilitated differentiation at genetic level. A small shortcoming is the usage of outdated taxonomic and/or nomenclatural concepts, e.g. *Rorella* and *Rossolis* are superfluous and illegitimate synonyms of the typical subgenus *Drosera* and section *Drosera*, respectively. *Drosophyllum* (Drosophyllaceae) is evidently an alien element in Droseraceae, as demonstrated not only by recent genetic data that place it unambiguously in the immediate vicin-

ity of Dioncophyllaceae and Ancistrocladaceae, but also by palynological, anatomical, and morphological evidence. Anyway, both papers contain valuable information and are well worth reading. (JS)

Ichiishi, S., Nagamitsu, T., Kondo, Y., Iwashina, T., Kondo, K. & Tagashira, N. 1999, Effects of Macro-components and Sucrose in the Medium on in vitro Red-color Pigmentation in *Dionaea muscipula* Ellis and *Drosera spatulata* Labill., Plant Biotechnology, 16:235-238.

Plants of *Dionaea muscipula* and *Drosera spatulata* cultivated in vitro on media containing elevated concentrations of nitrogenous compounds (NH_4NO_3 and KNO_3) showed increased proliferation by multiple shoots and generated large green plants, while plants on media with diminished concentrations of nitrogenous compounds and increased concentrations of sucrose displayed decreased size and deeper red colouration that spread from the glands or tentacles to the entire leaves. The anthocyanins responsible for the red colouration in both species are identified. (JS)

Mendez, M. & Karlsson, P.S. 1999, Costs and Benefits of Carnivory in Plants: Insights from the Photosynthetic Performance of Four Carnivorous Plants in a Subarctic Environment, Oikos 86: 105-112.

Photosynthetc rates of the four tested carnivorous plants (*Pinguicula vulgaris*, *P. alpina*, *P. villosa*, and *Drosera rotundifolia*) were lower than those of non-carnivorous plants from the same habitats. The photosynthetic capacity of the carnivorous plants studied increased with leaf nitrogen content (without reaching the level of non-carnivorous plants), but this is a trend observed generally also in non-carnivorous plants. The authors hypothesize that the main benefit from carnivory is enhanced reproduction rather than enhanced photosynthetic carbon fixation, at least in subarctic environments. Perhaps low photosynthetic carbon fixation is compensated by carbon obtained from prey here. (JS)

Moran, J.A., Booth, W.E., & Charles, J. 1999, Aspects of Pitcher Morphology and Spectral Characteristics of Six Bornean *Nepenthes* Pitcher Plant Species: Implications for Prey Capture, Annals of Botany 83: 512-528.

The authors found interspecific differences in *Nepenthes* pitcher form (they were, by the way, not really the first in this respect: in fact, many species in the genus are defined by little more than their particular pitcher forms!) and spectral reflectance patterns. They deduced from this that different prey is attracted by different species. This was partially confirmed by the analysis of prey captured. (JS)

Murphy, P.B. & Boyd, R.S. 1999, Population Status and Habitat Characterization of the Endangered Plant, *Sarracenia rubra* subspecies *alabamensis*, Castanea 64: 101-113.

Interestingly, 60% of all individuals surveyed in this study were found in a single site (out of a total eleven known remaining ones, most of which being seepage bogs). Threats to the sites include development, livestock grazing, mining, and the absence of fire (NB: Overcollection and trade, the essential "T" in CITES, are not mentioned!). (JS)

Nicholas, A., & Kondo, K. 1998, A Chromosome Study in *Drosera* of KwaZulu-Natal, South Africa, Chromosome Science, 2: 47-49.

Three chromosome counts are communicated (2n=40 for *Drosera collinsiae*, *D. madagascariensis*, and *D. natalensis*), of which the count for *D. collinsiae* is new (the count of *D. natalensis*—under the synonym *D. venusta*—was published already by Debbert in 1987, and that of *D. madagascariensis* was published already by Kress in 1970). Furthermore, the new count of 2n=40 for *D. dielsiana* is mentioned informally (as "Hoshi & Kondo, unpublished") on p. 47 (see reviews above). All species investigated have small chromosomes at mitotic metaphase that do have diffused centromeres. The chromosomal similarities between all these species are possibly due to (or the reason for the ease of) frequent gene-flow between the taxa. This would be a plausible explanation for the difficulties associated with circumscription of some of the species. (JS)

Nyoka, S.E., & Ferguson, C. 1999, Pollinators of *Darlingtonia californica* Torr., the California Pitcher Plant, Natural Areas Journal, 19(4): 386-391.

This is an interesting review of the mystery regarding the pollinators of *Darlingtonia*. Despite the fact that *Darlingtonia* flowers, like those of *Sarracenia*, appear to be modified for pollination by specific arthropods, convincing candidate pollinators have never been identified. The authors used traps to collect arthropods in *Darlingtonia* habitat and inspected them for *Darlingtonia* pollen. Over a ten-week period, 1758 insects were collected; 27 species carried pollen, but only four were found carrying *Darlingtonia* pollen! It is unlikely these are the *Darlingtonia* pollinators since only eight individuals were carrying pollen—the vast majority of the individuals in these species were not found bearing *Darlingtonia* pollen.

So what is responsible for the copious annual seed production? Flowers enclosed in mesh bags that exclude 0.75mm or larger arthropods resulted in negligible seed production, so wind can be discounted (personal observation). The authors suggest that web-building spiders are the active pollinators. (Even the most casual observer of *Darlingtonia* flowering in the wild will note that nearly every flower has a resident spider and web.) While this is not a new theory, the authors construct a plausible model for spider pollination, in which the juvenile spiders survive perhaps exclusively on nectar and pollen (few prey items are found in their webs). The pollen and nectar diet may sustain the young spiders until the annual prey population rises. Pollen/nectar feeding has been documented in various spider families, including some represented in *Darlingtonia* habitat. The most commonly collected *Darlingtonia* spiders were *Clubiona pacifica* and *Theridion differens*. The irony of vegetarian carnivores living in carnivorous vegetables is extreme! (BAMR)

Owen, T.P. & Lennon, K.A. 1999, Structure and Development of the Pitchers from the Carnivorous Plant *Nepenthes alata* (Nepenthaceae), Am.J.Bot. 86: 1382-1390.

The ontogenetic development of the secretory and absorptive glands of *N. alata* was studied and is described in this paper together with many data that have already been rerported earlier. The digestive glands at the base of the pitcher develop from single protodermal cells, which is not uncommon in such structures. (JS)

Schulze, W., Frommer, W.B. & Ward, J.M. 1999, Transporters for Ammonium, Amino Acids and Peptides are Expressed in Pitchers of the Carnivorous Plant *Nepenthes*, The Plant Journal, 17: 637-646.

The three classes of transporter proteins mentioned in the title have been shown to be expressed in various regions of the digestive zone of pitchers of *N. alata*. Their subcellular localization has been elucidated by in situ hybridization techniques. Some of the microscopic images are so spectacular that one of them was chosen as the title photo of this issue of the journal. This paper is highly recommended to all interested in the physiological details of digestion in carnivorous plants. (JS)

Spomer, G.G. 1999, Evidence of Protocarnivorous Capabilities in *Geranium viscosissimum* and *Potentilla arguta* and Other Sticky Plants, Int. J. Plant Sci., 160: 98-101.

Another interesting paper using circumstantial and (!) experimental evidence to show that carnivorous plants are not a strictly defined group. Protein digestion was tested by a modified film test, and absorption of digestion products was tested by application of radioactively labeled algal protein and detection of the label at positions in the plant that were remote from the points of application. The term "protocarnivorous" coined in this paper is unfortunate because it evokes the illusion that the author can forecast an evolutionary process. The neutral term "subcarnivorous" would be more appropriate. The nutritional significance of carnivory to the plants investigated was not studied in detail but the usefulness of (genetically?) engineered sticky crops able to utilize their prey via carnivory is discussed briefly. However, the (presumably limited) public acceptance of such products is not considered. (JS)

Worley, A.C. & Harder, L.D. 1999, Consequences of Preformation for Dynamic Resource Allocation by a Carnivorous Herb, *Pinguicula vulgaris* (Lentibulariaceae), Am.J.Bot. 86: 1136-1145.

Feeding of fruit flies to the common butterwort resulted in larger plants with more flowers and enhanced vegetative reproduction after one growing season but not within the same growing season, because the primordia for rosettes and flowers are formed 10 months before the organs develop. (JS)

Zamudio, S. 1999, *Pinguicula elizabethiae* una nueva especie de la seccion *Orcheosanthus* (Lentibulariaceae) de los estados de Hidalgo y Queretaro, Mexico. (*Pinguicula elizabethiae*, a new species of sect. *Orcheosanthus* (Lentibulariaceae) from the states Hidalgo and Queretaro, Mexico, in Spanish, with English abstract), Acta Botanica Mexicana 47: 15-22.

This new species is similar to the two known ones with round corolla lobes, *P. colimensis* and *P. cyclosecta*, but it differs from the first by summer leaves with slightly involute (vs. revolute in *P. colimensis*) margins and winter leaves that are oblong-spathulate (vs. oblong-lanceolate), and from the second by summer leaves that are obovate-spathulate to suborbicular-spathulate with dense multicellular, up to 5 mm long trichomes at their bases (vs. obovate-spathulate, with hairs up to 2 mm long). Like any other addition to the difficult section *Orcheosanthus*, this further increases the urgency of a fundamental revision. (JS)

Chris Teichreb (Department of Biological Sciences, Simon Fraser University, Burnaby, B.C., V5A 1S6, Canada, cjteichr@sfu.ca) kept us informed as to the activities of the Pacific Northwest Carnivorous Plant Club (PNWCPC): We had our annual carnivorous plant show and sale at the Richmond Nature Park, south of Vancouver, Canada. Die-hard members were in attendance, some as far away as Kent, Washington. Many plants were on display for the public, and many others were sold at very reasonable prices. Kids and adults alike were awestruck with the variety of carnivorous plants, most people being familiar only with the Venus flytrap or our native sundews. While most of the public was taken aback by the size of the pitchers on some of the *Nepenthes* my personal favorites were a deep maroon coloured *Cephalotus* in full bloom and *Pinguicula gypsicola*. Proceeds from the sales of plants and care sheets were donated to the Richmond Nature Park. After the show and sale we had our general meeting. We have two shows and sales per year (in May and October). We are especially hoping to appeal to the younger generation, potentially through school tours, to help educate them on the importance of these plants and increase our membership. We hope to build a demonstration bog to further educate the public. For more information on the PNWCPC, write to me or visit our web site (www.nurserysite.com/clubs/pnwcarnivorous).

Doug Atlas (889 Rhue Haus Lane, Hummelstown, PA, 17036 USA, doug_atlas@hotmail.com) sent us a great photograph of one of his Venus Flytrap plants. It is not too uncommon for a Venus Flytrap's flowering stalk to produce a plantlet instead of flowers. But Doug's plant has gone one step beyond this—his plant's inflorescence-borne plantlets have flowered and produced their own plantlets, all while still on the stalk! (See Figure) Incidentally, while the phenomenon of plants producing plantlets on their flower stalks is often referred to as apomixis, this is not quite correct. Apomixis refers to when seeds are formed without the normal steps of pollination. The replacement of flowers with plantlets is more properly called "prolification" or "false vivipary." Whatever you call it, Doug worked magic! Doug would like to hear from other carnivorous plant growers in the Hershey/Harrisburg area.

Doug Atlas's Flytrap

James T. Robinson (1201 N. Race Avenue Arlington Heights IL 60004 USA jtrobinson@household.com) writes: Sphagnum is generally regarded as the moss of choice in which to grow carnivorous plants. But it is not without its problems. When healthy, sphagnum can quickly overrun smaller carnivorous plants and seedlings. When dead, it forms a rather unattractive base and it dies fairly easily if growing conditions are not right. But you may have an effective alternative to sphagnum right in your own yard if you live in the right climate. Check your lawn under shade trees,

or along rocky walls, and you may find moss growing. Pluck some out, rinse and squeeze it under the garden hose, and top-dress some of your carnivorous plant pots with it. Once it picks up moisture from the sand-peat growing medium, it greens-up quickly and grows nicely, forming an attractive, living base.

In my lawn I have at least two different types of moss. Arranged in a mosaic with a couple of sphagnum tips, these make a beautiful top-dressing that compliments the carnivorous plants. A bed of lawn moss also serves as an ideal medium for germinating carnivorous plant seeds. And say good-bye to your peat-sand being washed from your pots by heavy rain; your lawn moss dressing will hold it in place. If you over-winter your carnivorous plant pots under a straw mulch, your lawn moss dressing will green right up in the spring. Give it a try. You will enjoy the results.

Book Review

Camilleri, Tony. 1998. Carnivorous Plants. Kangaroo Press, East Roseville, New South Wales, Australia. ISBN 0-86417-917-0, 104 p., approximately 110 color photographs, 20 drawn figures and maps. Paperback, 28 × 21 cm (11 × 8.25 in), $16.00 (via Amazon.com).

Reviewed by Barry Meyers-Rice

From Australia comes this book on cultivating carnivores. It is essentially another, standard-format book on carnivorous plant horticulture—the same topics are covered in this book that are covered in most carnivorous plant horticulture books. So while the intermediate or advanced grower may not want to buy it (unless to complete a library or to enjoy its photographs), it would be a fine book for a novice to begin with.

In comparing this to the recent book by D'Amato, I find Camilleri's book has a little less substance (it is, after all, only 104 pages), while it puts a greater emphasis on large photographs. These images are lovely—some are even stunning. (It seems the photography drove the text, and not the other way around!). Unfortunately, the Latin names used throughout the book are occasionally misspelled, and invalid botanical names and cultivars are frequently coined (i.e., "*Sarracenia purpurea typica*", "*Dionaea* 'Big Mouth'").

Minor criticisms aside, this is an attractive book. The cultivation instructions are good and the photographs are lovely. If you want a copy, buy one quickly since it may, like so many carnivorous plant books, go out of print quickly!

Looking Back: CPN 25 years ago

"Of great importance for the survival of the winter buds [of temperate *Pinguicula*] is the temperature. All 14 species grow at habitats with winter air temperatures occasionally or constantly below the freezing point. But for successful hibernation of *Pinguicula* it is vital to know that the winter soil temperatures are generally just at the freezing point or only very slightly below or above it." This excerpt is from an astonishingly complete, eleven page article Jürg Steiger wrote on temperate *Pinguicula*. Even today, this piece is considered a bible for cultivating temperate species!

Instructions to Authors

Carnivorous Plant Newsletter is the official journal of The International Carnivorous Plant Society. It is dedicated to the distribution of knowledge about carnivorous plants, including information on cultivation, conservation, and related fields of general and applied botany. Carnivorous Plant Newsletter thrives only because of a steady stream of material from its readership; members of the Society are encouraged to submit articles.

It may take up to a year or more for a contribution to be published, and a manuscript may be edited to some degree prior to publication. Brief and clear writing will result in the minimum number of editorial changes. Authors will be contacted only if the editorial modifications are significant. The editors may request external peer reviews. If certain external peers should be excluded from the reviewing process, this must be stated in a cover letter. If your manuscript is a scientific work, you may request we publish a "received by" date on the first page of your article.

All contributions except cultivar descriptions and News & Views pieces must have a title. Include a list of the names and addresses of all the authors. Indicate which author should be contacted if we require more information. If possible, include an email address for this author. This information will be printed, unless you request otherwise.

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The Savage Garden: Chilly Nights

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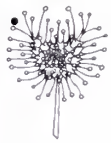

Keywords: cultivation.

Some of the most fascinating carnivorous plants come from climates that are usually considered Mediterranean or maritime. These include such beast as *Cephalotus*, the West Australian Pitcher Plant; *Drosophyllum*, the Dewy Pine that grows primarily near the coast of Portugal; and *Darlingtonia*, the Cobra Plant from California and Oregon. There are many others, particularly sundews from West Australia and South Africa, like *Drosera regia* and the Cape sundews. Another highly coveted group of carnivores is species that grow near the equator but at high elevations, such as *Heliamphora* and most *Nepenthes*. In fact, while centered on the tropical island of Borneo (which is bisected by the equator and certainly as torrid as a climatic zone can get), around seventy percent of the Tropical Pitcher Plants grow at elevations higher than 900-1200 m (3000-4000 feet). The climate at these altitudes is cool, particularly at night.

Many hobbyists succumb to the pulsing ache of desire to grow these cool-loving plants without considering this key element of their survival. These folks may pay a high price for these rare plants, or may attempt to grow them from seed. Reflecting upon their thriving specimens of Venus Flytraps and American Pitcher Plants, they may become confident they can do as well with the mustached *Darlingtonia* or toothsome *Nepenthes villosa*.

Take heed, dear grower! To truly succeed with Mediterranean or tropical highland species, you may have to do one of two things: move or invest in a good air-conditioner!

The key to making such vegetable gargoyles truly happy and hungry is simple: cool nights. This means temperatures dropping to between 10-15°C (50-60°F). Some of these plants may survive slightly warmer night temperatures for the summer, if you can at least lower the temperature to below 18°C (65°F). This nightly cooling is, of course, easier to attain in winter, but you may have to lower your house thermostat considerably if you grow such plants in a terrarium or on a sunny windowsill.

I am often amazed at the cultural differences in things such as home heating. Most Europeans and folks on the west coast of North America, where summer nights are often cool, never think of heating their homes in summer and let winter night temperatures drop into the 10°C range (lower 50s°F). Yet many a time I will get a phone call from some other location, from a person who wishes to grow a plant such as highland *Nepenthes* in a living room terrarium. When I find out their heat goes on in winter when temperatures drop below 20°C (68°F), I tell them to drop it to 10°C (50°F) or lower, or switch to tropical lowland plants.

This does not mean that temperatures need to plummet once the sun goes down. In my own experience I believe the crucial hours of cooling the temperatures is between midnight and 6 a.m.

The length to which a grower may go to create the ideal cool temperatures many a carnivore may require was shown to me during a visit to Florida several years ago. Cliff Dodd had a highland greenhouse festooned with luxurious vines of the most exotic *Nepenthes* available at the time. Along one wall of the compact glasshouse was not one, but two air-conditioners, running at full blast. After a few minutes in the breezy chill, I had to escape to the heat outside! His second location for growing highland plants was a concrete sub-basement, where I saw the most

awesome, perfect specimens of *Heliamphora* I had ever laid eyes on. He grew them in massive tanks under growlights, the glass enclosures beaded with dew. Again, air-conditioners blasted cold air. It reminded me of an intrepid explorer who told me of seeing the Sun Pitchers in Venezuela. "Here we were practically on the equator, and I was so wet and cold after being in the sweltering heat of Caracas, my lips turned blue and my teeth were chattering!"

If you have a partitioned greenhouse or a room or basement where you wish to grow such plants, it does no necessarily mean a huge investment in central air-conditioning. Last summer I played tourist in the desert town of Virginia City, Nevada. It was 41°C (106°F) outdoors in the shade, yet I wandered into a small gift shop that had its saloon-style swinging doors wide open. Inside the shop, the air was downright chilly. In one corner was what appeared to be a simple, free-standing fan. Upon closer inspection, I saw it was some new design of a portable air-conditioner—a type I had never before seen. I could hardly believe the cold wind blowing from it. It simply plugged into a regular electrical outlet. I marveled with the proprietor, who told me it was new on the market and reasonably cost-effective to run. I thought of how helpful it would be when growing cool-adapted plants. It was definitely superior to bulky window air-conditioners or central air-conditioning systems.

Of course, the other way to get a colder climate is to move! I have known at least a couple of serious growers who have done just that: they relocated to a more hospitable climate to grow the plants they love. Now the only thing they have to fret about is global warming!

In previous columns I moaned and groaned about the poor results I had experimenting with coco peat, the product derived from coconuts. I last left this subject by mentioning I would try coco chips, a similar product, with *Nepenthes* and *Heliamphora*. After six months the results are in: total disaster! I transplanted a number of specimens from the two genera into soil mixes using a liberal amount of the chip product. The symptoms were identical with both types of pitcher plants. While only a few plants died outright, the remainder grew but slowly, and the pitchers developed malformed and turned crispy brown prematurely. The sickly symptoms were so obvious that I could pick out the plants potted with coco chips among many others that had not been and were healthy. In conclusion, all horticultural products made from coconut fiber should be avoided due to their high salt contents.

John de Kanel
Your source for Nepenthes, Heliamphora and Cephalotus
E-mail: de_kanel@email.msn.com

Send No Money Now! . We now accept Visa and MasterCard in addition to personal checks. Phone, E-mail, or mail your inquiry to confirm availability (95% of plants requested are in stock at time of order). Provide your e-mail address (if available), phone number, and shipping address with your inquiry. All plants are artificially propagated and hardened off and guaranteed for 30 days. Shipping costs depend on quantity ordered and average $8 for Priority Mail and $23 for Express Mail within the U.S. Prices are subject to change without notice. Plant size is indicated by pitcher height for Heliamphora and overall length of leaf and trap for Nepenthes. Plants ship within 1 week of receipt of payment.

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Species/Hybrid Name	Native Area, Description Leaf Length in Inches	US $
C. follicularis	Australia (1.5" diameter) (2 plants)	13
H. heterodoxa	Gran Sabana, Venezuela (4" pitchers)	80
H. ionasi	Ilu Tepui., Venezuela (1.5" pitchers)	65
H. minor	AuyanTepui, Venezuela (4" pitchers)	80
H. minor	Akopan Tepui, Venezuela, hairy, (4")	80
H. nutans	C. Kukenam, Venezuela (1.5" pitchers)	30
H. tatei	C. Huachamachari, Venezuela (2" pitchers)	65
N. alata	Palawan, Philippines (3" leaves)	20
N. alata	Philippines (dark red traps, 4" leaves)	40
N. albo-marginata	Penang, Malaysia (green trap, 3")	22
N. albo-marginata	Penang, Malaysia (all red variety, 2")	43
N. ampullaria	Sarawak, Malaysia (green, 4" leaves)	27
N. ampullaria	Sarawak, Malaysia (speckled, 4")	35
N. ampullaria	Sipitang, Borneo (4" leaves)	20
N. aristolochioides	Sumatra (1" leaves, >2" diameter)	59
N. bellii	Mindanao, Philippines (2" leaves)	38
N. bicalcarata	Borneo (4" leaves, >8" diameter)	45
N. bongso	G. Talang, Indonesia (2" leaves)	50
N. burbidgeae	G. Kinabalu, Sabah (2" leaves)	89
N. burkei	Philippines (3" leaves, >6" diameter)	25
N. caranculata	G. Sago, Sumatra (2" leaves)	35
N. clipeata	G. Kelam, Borneo (3" leaves)	80
N. danseri	Waigeo Island, Irian Jaya (4" leaves)	40
N. deaniana	Palawan (2" leaves, >4" diameter)	50
N. distillatoria	Sri Lanka (3" leaves, >6" diameter)	19
N. ephippiata	G. Raya, Borneo (2" leaves)	45
N. eustachya	K. Sembilan, Sumatra (3" leaves)	55
N. eymae	G. Lumut, Sulawesi, Indonesia (1")	60
N. fusca	Sabah (2" leaves, >4" diameter)	30
N. gracilis	Talangka Rajah, Borneo (3" leaves)	15
N. gracillima	Genting Highlands, Malaysia (2")	40
N. gymnamphora	G. Singgalang, Sumatra (1")	40
N. hamata	Sulawesi (1.5" leaves, >3" diameter)	95
N. hirsuta	Sarawak, Malaysia (1" leaves)	35
N. hispida	Malaysia (3" leaves, >6" diameter)	45
N. insignis	E. Biak, Indonesia (3" leaves)	50
N. khasiana	Meghalaya, India (2" leaves)	15
N. lamii	Irian Jaya (2" leaves)	50
N. lowii	Brunei (1.5" leaves, >3" diameter)	50
N. lowii	G. Mulu, Sarawak (1" leaves)	50
N. lowii	G. Trusmadi, Sabah (2" leaves)	50
N. lowii	G. Murud, 6400 ft (1" leaves)	50
N. lowii	G. Kinabalu, Sabah (1" leaves)	65
N. macfarlanei	Genting Highlands, Malaysia (2")	30
N. macrophylla	G. Trusmadi, Borneo (3/4" leaves)	80
N. macrovulgaris	G. Silam, Sabah, Malaysia (1" leaves)	35
N. madagascariensis	Madagascar (2" leaves, >4" diameter)	15
N. maesolensis	Madagascar (1" leaves)	30
N. maxima	Rantepao, Sulawesi (2" leaves)	30
N. maxima	Celebes (2" leaves, > 4" diameter)	30
N. maxima	Anggi Lakes, Irian Jaya (2" leaves)	35
N. maxima	G. Cobray, 7260 ft. (1" leaves)	40
N. maxima	Indonesia (4" leaves, >7" diameter)	45
N. merrilliana	Philippines (2" leaves, >4" diameter)	35

Species/Hybrid Name	Native Area, Description Leaf Length in Inches	US $
N. mirabilis	Cape York, Australia (2" leaves)	15
N. mirabilis	Brunei (Echinostoma, 3" leaves)	45
N. muluensis	G. Mulu, Sarawak (2" leaves, >4" diam.)	60
N. murudensis	G. Murud, 7000 ft. (2" leaves)	60
N. neogunieensis	Angkasa, Irian Jaya (3" leaves)	60
N. northiana	Bau, Sarawak (3" leaves, >5" diameter)	50
N. pectinata	G. Singalang, Sumatra (2" leaves)	70
N. pervillei	Seychelles (2" leaves)	40
N. pilosa	G. Batu Buli, Sarawak (1" leaves)	35
N. rafflesiana	Malaysia (green traps, >4" leaves)	15
N. rafflesiana	Sandakan (2" leaves)	40
N. rafflesiana	Bau, Sarawak (giant form, 5" leaves)	50
N. rajah	G. Kinabalu, Sabah (1" leaves)	40
N. ramispina	G. Ulu Kali, Malaysia (1" leaves)	25
N. reinwardtiana	Borneo (green trap, 2" leaves)	20
N. reinwardtiana	Telupid, Sarawak (red trap, 2" leaves)	30
N. reinwardtiana	G. Murud, 6900 ft. (1" leaves)	40
N. sanguinea	Genting Highlands, Malaysia (3")	20
N. sibuyanensis	Sibuyan, Philippines (2" leaves)	30
N. spathulata	Sumatra (2" leaves, >4" diameter)	60
N. stenophylla	Sarawak (2" leaves, >4" diameter)	60
N. sumatrana	Sibolga, Sumatra (3" leaves)	40
N. tentaculata	G. Murud (1" leaves)	30
N. thorelli	Phuk Radung, E. Thailand (3" leaves)	30
N. tobaica	Sumatra (red pitcher) (3" leaves)	35
N. tomoriana	Sulawesi (1" leaves, >2" diameter)	45
N. treubiana	Sibolga, Sumatra (3" leaves)	40
N. truncata	Philippines (4" leaves, >7"diameter)	40
N. veitchii (highland)	Batu Lawi, Sarawak (2" leaves)	45
N. veitchii (lowland)	Sungai Samba, Borneo (2" leaves)	40
N. ventricosa	Philippines (3" leaves, 5" diameter)	15
N. ventricosa	Philippines (green traps with dark red peristome, very unusual, 4" leaves)	35
N. vieillardii	New Caledonia (2" leaves)	30
N. villosa	G. Kinabalu, Sabah (3/4" leaves)	60
Selected Hybrids		
N. bicalcarata x ampullaria	Sipitang, Sabah (very vigorous with dark red/green leaves, 3" leaves)	30
N. bongso x maxima	(3" leaves	50
N. fusca x burbidgeae	(2" leaves)	45
N. x hookeriana	Peninsular Malaysia (3")	45
N. khasiana x truncata	(3" leaves)	40
N. sanguinea x truncata	(2" leaves)	40
N. spathulata x veitchii	(2" leaves)	40
N. truncata x maxima	(4" leaves)	40
N. truncata x ventricosa	(4" leaves)	40
N. veitchii x lowii	(3" leaves)	40
N. ventricosa x inermis	(4" leaves)	40
Victorian Hybrids	Spectacular Traps (>4" leaves)	
N. x chelsonii	London, Late 1800's	25
N. x coccinea	London, Late 1800's	25
N. x dyeriana	London, Late 1800's	50
N. x edinensis	London, Late 1800's	25
N. x mixta	London, Late 1800's	30
N. x wrigleyana	London, Late 1800's	25

New Cultivars Registered in 1999

Name	Established by, in	Registered on
Sarracenia 'Okee Giant'	P. D'Amato, Savage Garden: 85 (1998)	11. 6. 1999
Sarracenia 'Red Ruffles'	P. D'Amato, Savage Garden: 76 (1998)	11. 6. 1999
Dionaea 'Red Piranha'	E. Read, Carniv. Pl. Newslett. 28: 99 (1999)	18. 9. 1999
Drosera 'Cuba'	P. D'Amato, Savage Garden: 137 (1998)	11. 6. 1999
Drosera 'Giant'	P. D'Amato, Savage Garden: 140 (1998)	11. 6. 1999
Nepenthes 'Jack Finney'	P. D'Amato, Savage Garden: 273 (1998)	11. 6. 1999
Nepenthes 'John Rizzi'	P. D'Amato, Savage Garden: 212 (1998)	11. 6. 1999
Pinguicula 'Pale Flower'	P. D'Amato, Savage Garden: 205 (1998)	11. 6. 1999

International Carnivorous Plant Society Seed Bank

Tom Johnson, Coordinator • P.O. Box 12281 • La Crescenta, CA 91224-0981 • USA
tom@carnivorousplants.org • http://www.primenet.com/~tjjohns/seed.htm

Darlingtonia californica
D. californica—Josephine Co., Oregon
D. californica—Nevada Co., California
Drosera aliciae
D. anglica (Californian × Hawaiian)
D. auriculata
D. brevifolia—white flower, Hampstead North Carolina
D. burmannii—Beerwah, Queensland
D. capensis—green
D. capensis—narrow leaf
D. capensis—narrow leaf, Albion, California
D. capensis—purple flower
D. capensis—white flower
D. capillaris
D. capillaris—upright leaves, Osco Co., Florida
D. filiformis var. *filiformis*
D. filiformis var. *filiformis*—Manchester, New Jersey
D. gigantea
D. glanduligera
D. indica—Cairns, Australia
D. intermedia
D. intermedia—Carolina giant form
D. intermedia—southeast Virginia
D. macrantha subsp. *macrantha*—pink flower
D. peltata
D. planchonii
D. rotundifolia—Manchester, New Jersey
D. rotundifolia—Mendocino Co., California
D. rotundifolia—Willow Lake, Nevada Co., California
D. stenopetala
D. stolonifera subsp. *rupicola*
D. stolonifera subsp. *stolonifera*
D. whittakeri
D. dielsiana × *nidiformis*
Sarracenia flava
S. flava—Ben Hill Co., Georgia
S. flava—Hampstead, North Carolina
S. leucophylla
S. minor—Fitzgerald, Ben Hill Co., Georgia
S. purpurea subsp. *purpurea*
S. purpurea subsp. *purpurea*—north Ohio plains
Miscellaneous noncarnivores:
Ibicella lutea
Mimosa pudica—sensitive plant

All seed contributions are gratefully accepted. You must use bubble wrap to protect the seeds from shipping damage.

The seed bank listing is only an approximation to the current seed bank inventory. Before ordering any seed you should request an updated listing from Tom Johnson (the Seed Bank Coordinator). A plant followed by an entry in parentheses means there are a limited number of seed packets remaining.

All orders and correspondence with the seed bank must be accompanied by a self addressed, stamped envelope. Postage is $.33 for a seed list, $.55 when ordering seed. Seed costs $1 per packet. IRCs are accepted. You should specify alternative seeds with each order in case your first choices are no longer in stock.